

SECTION 75**INSULATION AND LAGGING FOR PIPING, EQUIPMENT AND MACHINERY**

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75.1 REFERENCES

(75A) ASTM F683 - *Standard Practice for Selection and Application of Thermal Insulation for Piping and Machinery*

75.2 INTRODUCTION

This Section contains the Contractor's Design and Provide general requirements for thermal insulation of machinery, equipment and piping to reduce the rate of heat transfer and to protect personnel; anti-sweat treatment to reduce condensation; and vapor barrier application to prevent insulation from absorbing moisture.

Special application and installation techniques shall be used where necessary to prevent condensation, icing and freezing problems associated with the low temperature environment.

Reference (75A) shall be followed except where it may deviate from Authoritative Agency requirements or standard practice for accommodations and the Food Vending areas as described in other authoritative publications, or as modified by requirements contained herein.

All materials shall be certified asbestos free. Certifications shall be provided for WSF prior to installation.

For WSF Fleet-wide Standardization purposes, End No. 1 of the Vessel shall always be considered the bow, and this designation shall delineate port and starboard, fore and aft wherever they are addressed in the Technical Specification.

75.3 GENERAL

Provide insulation and lagging for machinery, piping systems and components, in accordance with Reference (75A) except where otherwise specified, using materials approved by the USCG. Comply with 46 CFR §72.05-40.

Unless otherwise specified, all piping and piping components having external surfaces of 125F degrees or greater, all domestic hot water piping and piping components, and all heating water piping shall be insulated.

Unless otherwise specified, all piping and components conveying fluids below 50F degrees shall be covered with anti-sweat insulation where necessary to prevent undesirable condensation, or to limit the absorption of external heat that may be detrimental to the operation of the system.

Piping systems in weather and unheated voids shall be insulated where necessary to protect from freezing.

Except where required for structural fire protection, or as specifically set forth in the Technical Specification, do not insulate the deluge sprinkler system nor piping systems which carry compressed air, lube oil or fuel oil.

Piping which penetrates insulated structural fire protection bulkheads or decks shall be insulated for at least twelve (12) inches (300 mm return) on the insulated side of the bulkhead or deck with structural insulation approved under 46 CFR §164.007. The thickness of insulation applied to the pipe must be the same as the bulkhead or deck penetrated.

Piping with design internal temperatures of 200F degrees and over shall be insulated from their supports.

Pre-lagged insulation meeting separate insulation and lagging requirements may be used if of a type that can be readily applied, fastened, removed, and reused. All insulating materials shall be properly secured to prevent sagging and to permit ready removal if required for maintenance of equipment. All material and adhesives shall satisfy the requirements of the Authoritative Agencies, including specifically the requirements of 46 CFR §164.

All insulation shall be protected from the effects of physical damage and external moisture.

See Section 14 of the Technical Specification for painting of surfaces before and after application of insulation and lagging. Insulation and sheet metal linings of structure shall be in accordance with Section 7 of the Technical Specification.

75.4 APPLICATION AND INSTALLATION

Required testing of piping shall be complete before pipe covering is installed over joints.

Straight runs of piping or tubing shall generally be insulated with molded or preformed type materials. Butt-end and longitudinal joint surfaces shall be sealed with a USCG approved joint compound, not more than $\frac{1}{16}$ inch thick.

On bends, elbows, and other piping joints, fit preformed or fabricated segments of the same insulation used on adjacent straight runs. All joints shall be tightly fitted and cemented together with a USCG approved joint sealing adhesive compound. Where required for rigidity, reinforce insulation with stainless steel wire mesh or netting. Apply approved insulating or insulating-finishing cements to fill crevices and smooth all surfaces.

Secure typical three (3) foot lengths of insulation with No.18 gage stainless steel wire at three (3) points on piping up to and including six (6) inch diameter and not less than four (4) points on larger pipes. Lengths less than three (3) feet shall be secured at two (2) points.

Sections of insulation shall have all joints tightly butted.

Where the pipe insulation abuts flanges and fittings, taper the ends of the insulation to permit free removal of bolts.

Insulation blankets shall have machine sewn edges using Teflon coated, stainless steel wire inserted thread. Provide lacing hooks spaced not over four (4) inches to secure the blanket. Lace blankets on using stainless steel wire so no gaps appear at the joints. Apply fibrous glass insulation in a single layer on piping where the required thickness is not over two (2) inches. Double layer insulation may be applied where the required thickness exceeds two (2) inches. Provide means to permit thermal movement of piping, without opening of insulation joints.

In multi-layer construction, apply the succeeding layers so all joints are staggered.

Coverings shall be installed so that movement of enclosed components will not damage the coverings. Fastenings shall not crush or otherwise reduce the insulating value of the insulation.

Piping in voids and cofferdams shall have thermal or anti-sweat insulation where omitting insulation may be detrimental to system operation or where condensation would promote corrosion or other damage.

- 1 Provide piping insulation for the various services according to **TABLE 75-1** below.
- 2 Select thickness to provide surface temperature less than the values given for the various
- 3 services in **TABLE 75-1**. In no instance shall the thickness be less than one (1) inch.
- 4 Provide lagging over all insulation, unless specifically exempted.

TABLE 75-1 Insulation Materials			
Service	Fluid Temp	Surface Temp	Insulation Material
Engine Exhaust	800F degrees	125F degrees	<u>Insulation Blankets:</u> <ul style="list-style-type: none"> • Stainless Steel wire mesh 0.008 in. Wire, No 60 density, against pipe. • 1,200°F degree needled glass or ceramic fiber mat, one (1) inch minimum thickness (Inner layer). • Glass or ceramic insulative wool, thickness to suit. • Cover with coated fiberglass (STEVENS 2025, Finish 9383 inside and 2025, Finish 9649 outside, or equal). • Secure in place with stainless lace and hooks.
Emergency & Ship's Service Diesel Generator exhaust	850F degrees	125F degrees	Same as engine exhaust.

TABLE 75-1, cont'd Insulation Materials			
Service	Fluid Temp	Surface Temp	Insulation Material
Oil-fired hot water heater uptake	500F degrees	125F degrees	Same as engine exhaust.
Electric hot water heating	190F degrees	110F degrees	Fibrous glass with glass cloth lagging
Engine jacket water	190F degrees	110F degrees	Removable blanket of fibrous glass cloth lagging. Only in areas subject to personnel contact.
Engine separate circuit after cooling (SCAC)	130F degrees	110F degrees	Removable blanket of fibrous glass cloth lagging. Only in areas subject to personnel contact.
Hot potable water	140F degrees	85F degrees	Fibrous glass with glass cloth lagging
Anti-sweat insulation	Less than 50F degrees	ambient	Fibrous glass, vapor barrier and glass cloth lagging.
Plumbing drains exposed to weather		38F degrees	Fibrous glass with cloth lagging and vapor barrier, sufficient to protect from freezing.

1 **Note:** Lagging, except as noted, shall be glass cloth of weights appropriate for the
2 pipe size.

3 For fire protection, surfaces that are excluded from insulation requirements and can attain a
4 temperature of 400F degrees or higher shall be shielded if impingement of a flammable fluid

on these surfaces is a possibility. See the *RESTRICTIONS* Subsection in Section 74 of the Technical Specification for additional safety requirements for prevention of spray from mechanical joints in flammable liquid piping. Where there is danger of personnel coming in contact with non-insulated hot piping, the piping shall be enclosed in shielding with approximately a 1/2 inch stand-off.

Supplementing the requirements of Section 74 of the Technical Specification pertaining to insulated bulkhead piping connections: For piping passing through joiner bulkheads or Vessel structure without the use of a bulkhead fitting (sleeve), the covering shall also run through intact in lieu of butting the covering to either side of the joiner work or structure. Where refrigerant pipes pass through a non-watertight insulated bulkhead into a refrigerated space, the insulation shall extend at least one (1) inch inside the refrigerated space.

A vapor barrier shall be applied to all insulation, as necessary, to prevent penetration of moisture. Vapor barriers shall remain intact and continuous over the areas protected by means of sealed joints and edges.

Anti-sweat insulation shall be provided on all components where it is necessary to limit absorption of heat from an external source which would be detrimental to the system and to prevent formation of condensation which may drip on personnel, or on such items as electrical equipment and machinery, stores and supplies.

For anti-sweat and refrigerant insulated piping, clamps shall be to the exterior of the insulation on a wrap of metal lagging or isolated from the pipe by 1/8-inch thick rubber sheet. For requirements pertaining to limitation of heat transmission from hot piping to adjacent structure, such as through pipe clamps, hangers, braces and anchors, see Section 74 of the Technical Specification.

In locations where the completed insulation and lagging is subject to physical damage, provide protective 20-USSG galvanized sheet metal over the insulation and fabric lagging.

Protective sheet metal lagging shall be installed adjacent to lavatories, service sinks, water closets, ovens, ranges, dishwashing machines and food preparation tables. It shall also be installed where insulation can become oil or water soaked, and in areas of heavy traffic. A surface treatment or covering shall be installed where necessary for the protection of personnel against cuts, abrasions or contact with hot surfaces.

The Hot Water Heating Head tank shall be insulated with at least 1 1/2 inches of cellular glass with glass cloth lagging.

75.5 VENTILATION DUCTS

Heating, ventilation and air conditioning machinery and duct work insulation requirements are provided in Section 12 of the Technical Specification.

75.6 COVERS AND PADS

Provide removable, reusable insulating pads around flanges, flanged fittings, valves, and expansion joints in insulated piping below 450F degrees. Pads shall be covered with fiberglass cloth, STEVENS Style 2025, finish 9649, or equal, enclosing a filler of mineral wool or glass fibers, machine sewn together, using Teflon coated, stainless steel wire inserted thread, as with insulation blankets. Pad thickness shall be equivalent to the adjacent fixed insulation. Secure the pads with latching hooks or wire lacing through eyes in the pads.

See the requirements for protective spray shields for flanged connections and valves on systems containing combustible or flammable liquids under pressure in the *RESTRICTIONS* Subsection in Section 74 of the Technical Specification.

75.7 SPARE PARTS AND INSTRUCTION MANUALS

Provide a list of recommended spare parts and special tools for those items that are Contractor furnished, together with parts lists and instruction manuals necessary to maintain and service provided equipment and accessories in accordance with the requirements of Sections 86 and 100 of the Technical Specification.

75.8 TESTS, TRIALS AND INSPECTIONS

Tests and/or trials shall be in accordance with this Section and Section 101 of the Technical Specification.

Inspections shall be performed as defined in this Section and Section 1 of the Technical Specification.

75.9 PHASE II TECHNICAL PROPOSAL REQUIREMENTS

The following drawing, in addition to other drawings required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase II Technical Proposal stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Schedule of Insulation and Lagging for Piping, Equipment and Machinery

75.10 PHASE III DETAIL DESIGN AND CONSTRUCTION REQUIREMENTS

The drawings required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase III Detail Design stage of Work in accordance with the requirements of Section 100 of the Technical Specification.

(END OF SECTION)